DEMOCRATIZING NEW SOCIAL INFRASTRUCTURE DEVELOPMENT: THE CASE OF TEACHER INVOLVEMENT IN SCHOOL DESIGN

ABSTRACT

Democratizing innovation looks at users as a source of innovation. Developers of commercial products have long been exhorted to involve them in design for leveraging knowledge on users' needs and context-of-use. Here, we explore whether democratizing innovation can be extended into social infrastructure development and, if so, how to make it work. Our longitudinal empirical study explores the involvement of head teachers and heads of faculty in new school development processes. The local authority – the project promoter – champions innovative designs so as to respond to new policy calling for operational changes over the facility lifetime. Teachers are selectively interested in design innovation, but also in replicating familiar features wary that radical designs may not fit the purpose in light of their practical experience of schooling youngsters. Our fieldwork suggests that allowing unfettered users to participate in infrastructure co-development is hard work. The stickiness of users' information is at odds both with tight budgets and timescales, as well as with sticky information on context-of-development. Promoters want to listen to users ultimately responsible for getting immediate value out of new assets, but cannot lose sight of the transitoriness of users' status vis-à-vis the expected operational longevity of the facilities. Two factors may contribute to achieve timely reconciliation of promoter'- and users' ideas: a bounded space of solutions at the onset of development and a governance structure capable to resolve conflicts in design decision-making and negotiate trade-offs. Further, stakeholders want to use hard evidence that innovations fit, or not, as a resource for persuading one another of the merit of her own ideas.

"The mathematicians, who're always odd, wanted blackboards. And I said 'this is an absolute joke, it's ridiculous - this lecture theatre costs £13m, and we're going to risk it putting blackboards and chalk dust. You can give them a white board and markers. Just tell them to get lost.." (Project sponsor)

1. INTRODUCTION

Involving users in the development of new commercial products and services has long been at the core of innovation research (Rothwell and Freeman 1974, Von Hippel 1976, 1977). This stream of the literature has elucidated how consumers have been major contributors of innovations in various sectors, including scientific instruments and manufacturing equipment (Von Hippel 1976, 77, Riggs and von Hippel 1994), software (von Hippel and von Krogh 2003, Franke and von Hippel 2003), extreme sport equipment (Franke and Shah 2003), and computer-controlled music instruments (Jeppesen and Frederiksen 2006). User involvement in development, or co-development, enables producers to learn about the needs of consumers and how to integrate them in new products and services. These needs can be hard to elicit by market-research departments, especially for high-tech products (von Hippel 1988). Designs that meet user needs generate high user satisfaction, which in turn can enhance the commercial performance of the firm and increases social welfare (Henckel and von Hippel 2005).

User-centered innovation literature has seldom, however, probed into the process of innovating social infrastructure. The process of co-developing infrastructure assets such as high school facilities exhibits two main distinctions relative to co-developing commercial products and services. First, social assets are developed to serve multiple user communities: a high school is used by students, teachers, and increasingly by local communities; a hospital is used by patients, doctors, nurses. Infrastructure promoters concerned with maximizing social welfare need to listen to the different

communities of users and find ways to incorporate their needs in the new designs. And second, the users of infrastructure assets are transitory vis-à-vis the expected operational longevity for the assets. A head teacher may retire a few years after the school opens and faculty heads come and go, while the school facility will serve generations of youngsters. This means that new designs must reconcile the immediate needs of current users with the foreseeable needs of prospective users in the future.

User-centered innovation literature suggests that social welfare is likely to be higher in a world in which both users and manufacturers innovate (Henckel and von Hippel 2005). The goal of commercial development should be to create solutions that satisfy the needs of real users within real contexts. As manufacturers empower users to innovate for themselves, innovation becomes *democratized* (von Hippel 2006). Uncovering whether social infrastructure development can also be *democratized*, and if so how to empower users in design, motivates this explorative empirical study. In doing so, we respond to Ouchi et al.'s (2005) call for more applications of management theory and research evidence to major public issues.

Our research setting is the implementation of the Building Schools for the Future (BSF) programme in the city of Manchester, UK. The Manchester BSF programme is a subset of a vast 15-year, £45bn programme initiated in 2002 to rebuild or renew UK's 3,5000 schools, as part of the government's educational reform agenda. A successful bid submitted by the Manchester City Council – the project promoter – to the Department for Education and Skills (DoES) secured £450m for the Council to rebuild or renew 33 schools. The ethos of the programme, "beyond bricks and mortar" as described in its documentation, was to "develop the capacity to deliver a 21st century learning experience and .provide children with a greater opportunity to foster talent and succeed outside education." From the onset of the programme, MCC opted

to involve teachers in the new school developments to the extent construction on site could start only after the head teacher signed off the design documents.

Our in-depth analysis of the processes to incorporate a number of innovations in the school designs reveals the challenges in democratizing social infrastructure development. Our analysis does not dismiss the power of co-development, on the contrary, but affirms its implementation as hard work. Stated bluntly, infrastructure co-development brings a lot of pain and gain. Our study suggests nonetheless some recommendations to management practice and policy that can lessen the pain.

User communities emerge as playing a dual role of innovator and imitator in design. Users are excited in incorporating innovations propped up on their practical experience, while reluctant to adopt ideas promoted by others wary that they can fail to work. The more users appear demonstrably satisfied with the operational results produced out of an existing facility, the more likely they are to fight untested ideas championed by others. Time to share evidence of how new ideas can work, or not, becomes essential to reconcile promoter's and users' views of the world, but the cost to transfer 'sticky' information (von Hippel 1994) may be unaffordable in project environments constrained in terms of budget, time, and people. The crux of the problem therefore becomes how to efficiently implement co-development. Our findings suggest that promoters may want to set up, first, boundaries around the space of design solutions; and second, an organization to govern design decision-making capable of negotiating trade-offs and of swiftly resolving conflicts about innovation.

2. USERS AS A SOURCE OF INNOVATION

The economics of the distributed innovation process across users, manufacturers, and suppliers are at the core of research on the role of users as a source of innovations (von Hippel 1988). The more users can expect to profit from innovation, the more

motivated they may be to contribute new ideas to the development of commercial products and services. Hence, user-centered innovation has been particularly important in sectors where users can introduce innovations in-house, as in the case of production equipment (e.g., von Hippel 1988, Slaughter 1993). Users can modify existing products without needing to tell manufacturers and risking those innovations get into the knowledge of their competitors. In other instances, manufacturers can explicitly encourage users to innovate by offering free equipment or design help (or discourage them by refusing to service products users have modified or sealing the products to hamper user access) (Jeppesen and Frederiksen 2006). Users have also an important role as innovators in the development of the free and open-source software movement, sectors where there are important user-innovation communities and rich 'intellectual commons' (von Hippel and von Krogh 2003, Jeppesen and Molin 2003).

Lundvall's work (1985, 88) further elucidates on three different patterns of user-manufacturer relations and how they affect innovation. The first category looks at users as individual consumers playing a passive role in the innovating process. A second category assumes manufacturers dominate over groups of professional users, controlling the direction of innovation. Manufacturers may even promote the development towards more and more complex hyper-automated products and services, forcing user groups to face cost inefficiencies. The third category includes large institutional users dominating manufacturers, such as the relation between the large US automobile industry and the relatively small tool manufacturers. In this case, the large user-firms might determine the innovation trajectory pursued by manufacturers by virtue of their own technological competence and size of demand. Institutional users may even rule out opportunities for the small manufacturers to introduce other innovations relevant to small users, such as cheap general purpose

machinery. Lundvall (1988) advocates policies which break up trajectories producing unsatisfactory innovations by strengthening the position, in terms of power and competence, of consumers in the first case, small users in the second, and small manufacturers in the third case. Lundvall (1985, 89) also argues for policy-making to play the role of "matchmaker" in user-producer relationships, strengthening the position and competence of weak parties in biased relationships, breaking down or renewing stubborn relations, and stimulating the establishment of new ones. Among the specific means of achieving this might be consultations and mediation between parties, educating parties with weak competence, and using duties and subsidies to encourage the formation of new relations.

User toolkits for innovation constitute another means through which manufacturers can allow consumers to participate in product and service development (e.g., von Hippel and Katz 2002, Franke and von Hippel 2003, Randall et al. 2007). This involves first partition the design task into a set of integrated subtasks, some of which require needs-based information from users and others require solution-based information from manufacturers. Toolkits then allow manufacturers to assign to users the subtasks requiring user-needs information as if users and developers were co-located. The goal is to enable users to design customer products that meet their exact needs (Thomke and von Hippel 2002). Effective toolkits enable users to go through a trial-and-error, problem-solving process during which they can create preliminary designs, simulate and prototype them, evaluate functioning and iteratively improve a design until they are satisfied. Evidence suggests that consumers prefer designing their own custom-products with the aid of a toolkit over manufacturer-centered development practices (von HIppel 2006). Randall et al. (2007), for example, have recently explored two approaches to produce user toolkits: In the parameter-based

approach, knowledgeable users are encouraged to build online their preferred system configuration by pulling from a number of discrete options available (e.g., hard drive capacity, video processor power). In the needs-based approach, users with limited domain knowledge can spell out their needs (e.g., foreseen usages, budget) which the digital interface will consider when building proposed configurations.

In particular, von Hippel's work has exhorted manufacturers to work closely with 'lead users,' consumers whose strong needs at the present can anticipate trends to adopt by mass consumers in the future. (Urban and von Hippel 1988). Innovations developed by lead users tend to increase commercial attractiveness, benefiting manufactures which incorporate the innovations in new products (Franke and von Hippel 2003). This phenomenon has perhaps reached extreme levels of implementation in niche markets like kite surfing, where manufacturers produce designs actually developed and tested by user communities (von Hippel 2006).

The same search for new ideas and maximizing social welfare underpins the involvement of users in the development of new social infrastructure. We next discuss how we set off to explore these issues in the new school development process.

3. METHODS

The research method is a longitudinal single-setting case study with multiple embedded units of analysis (Yin 1984). Inductive studies suit well to examine 'underexplored' topics (Eisenhardt 2007) as it is the case of user involvement in new social infrastructure development. The case study method is also appropriate as previous research evidences the criticality of socio-economic contextual factors to understand design decision-making on new infrastructure assets (Gil et al. 2007). Our units of analysis are innovations in school designs. Some innovations were championed by the promoter's delivery team and others by the teachers. Some

innovations were welcomed by both stakeholder groups, whereas others were received with skepticism by teachers in some schools. Some promoter-centered innovations were ultimately almost imposed to schools, whereas others were abandoned. Our case is longitudinal in the sense we studied schools which designs were frozen, schools which designs were in development, and schools which designs were still at the early stages of conceptualization.

Our choice of the research setting reflects the value of personal contacts as a means to gain access into an organization for the purposes of conducting qualitative research (Feldman 2003). Specifically; we took advantage of our personal ties with a senior manager involved in the BSF programme at the local council. Our first informal conversations about school co-development started in 2006 a few months after our contact was appointed programme manager for two new school projects that were in the design phase. The contrast of anecdotal evidence on the challenges and difficulties to co-develop schools with theory on democratizing innovation motivated the exploratory empirical study we present next.

Data Collection and Analysis

The fieldwork started early on in 2007. When we started our fieldwork, the design for five schools was developed and the projects had progressed into construction onsite; the designs for five other schools were being developed; and five other school projects were going through the early conceptualization stages. Our personal contact was our key informant. He walked us into the organization structure of the Manchester BSF programme and helped us to get authorization for accessing archival documents. He also introduced us to a number of colleagues involved in the programme (head of division, design managers, architects, teachers seconded to the council). We arranged face-to-face interviews with head teachers for the BSF schools

on our own since their names and contacts were available on the Internet. Whenever possible, we looked for finding contributions in kind (e.g., a master class to practitioners, a session on academic life to high school students) as a means to repay the generosity of our interviewees for making time to talk with us.

We started our analysis with a set of high-level open codes (Miles and Huberman 1994) from user-centered innovation literature, including design innovation, user- and promoted- generated information, lead user, and information stickiness. We looked for populating these categories throughout our focused interviews (Merton et al. 1956) with head teachers and members of the delivery teams. We subsequently cycled between readings of the verbatim transcripts of the interviews for codes and developing cross-case displays to make sense of case data, inducing new codes when appropriate (Langley 1999). We stopped cycling when we reached a plateau in our conceptual understanding about *democratizing* social infrastructure development.

We validated our insights by playing interview data against archival documents and information publicly available on the press and on BSF-related websites, namely Teachernet and Partnerships for Schools. In the latter domains, we could find information about recommended case studies, BSF standard documents, design guidance, lessons learned, education visions, governance structures, and funding arrangements. We are refining the scope of our work through a series of presentations and discussions with practitioners and scholars.

Research Setting: The Manchester BSF Programme

Manchester was one of the first local authorities to successfully bid for new school funding. The programme started in 2006 and its anticipated completion date was 2012. The £200m first phase (termed wave 1), which is at the heart of our empirical database, included 16 schools. The BSF programme was extremely important for

Manchester as some of its high schools experienced education attainment levels at the bottom nationally, with over 50% of pupils leaving school without achieving a qualification. The Council's decision to involve heads teachers and heads of faculty in the school design process was not standard across the UK. A nearby council, in particular, had become notorious for excluding head teachers from the development phase of a £150m programme to replace 10 schools with seven new learning centres.

The exchange of information between the project delivery teams and the head teachers and heads of faculty for each new school was facilitated by a Council's 'Learning Transformation Team.' This team comprised three former teachers knowledgeable about the learning transformation agenda underpinning the BSF programme. Their remit was twofold. On one hand, the transformation team was expected to elicit the needs and ideas of teachers for each school and pass these to the delivery teams. On the other hand, the transformation team was responsible for informing teachers about the ambition of the Council, and of the government itself, to use the BSF programme as an opportunity to deliver a transformation in learning. This role was summarized by the lead officer for learning transformation (2007):

> "I'm a bridge between design teams and schools. My task is to speak to head teachers and faculty leaders and draw provisions for what they want their school to provide, and how they are going to do it. This isn't in terms of what they want the building to look like, it's much more visionary, what they want people to learn."

We next analyze the differences between how delivery teams and user-teachers viewed innovations in design, and discuss the extent they managed to reconcile their views into the development of innovative school designs.

4. ANALYSIS

CONTEXT-OF-DEVELOPMENT INFORMATION

Three main forces informed the stance of the Council in the BSF programme: the goal to transform the delivery of education; the Council responsibility to administer the funding received from the government for delivering 33 new schools; and the Council accountability for the design quality of the new schools. We next analyze how these forces generated the information on the context-of-development which influenced the innovations that the Council sought to incorporate into the designs.

Information Generated from Programme Management

The school development programme unfolded in a resource-constrained environment in terms of time and budget as typical of project-based systems (Cleland and King 1983). The design of schools was also a process affected by a proliferation of standards, codes, tests and provisions for user protection as characteristic of processes directly affecting the welfare of the public (Rosenfeld 1994). Specifically, the budget for each school project was determined based on the minimum area requirements. This figure was calculated using formulae published in a design standard (BB 98, Briefing Framework for Secondary School Projects), which took as key input the number of pupils. This standard, described as a ‘kind of bible of school building’ in the words of a respondent, also gave guidance for designing specialized areas, including toilettes, sports hall, school grounds, and kitchen facilities. Delivery teams deemed the project budgets too tight since the formulae was set prior to changes in policy affecting school design, namely demands to make facilities friendlier to pupils with special educational needs and more environmentally sustainable. The latter modification, in particular, meant that the requirements for incorporating renewable technologies were 25% more stringent than those assumed in the BB98 calculations. Further, the Council had issued a guidance document applicable to all planning

applications posted post April 2007 calling for an additional voluntary reduction of 25% in carbon emissions. This policy aimed at meeting the Councils' aspiration to make Manchester the greenest city in Britain. While the government was providing additional funding (£0.5m/school) to help designs meet sustainability requirements, the Council representatives reckoned the provision was insufficient.

Because the rigid funding envelope for the BSF programme was fixed assuming a timescale to design and deliver each school, the Council was also concerned with the effects of inflation to the construction prices. Any slippage in the programme would increase the estimated cost to deliver the schools. This, in turn, would mean that either the Council would deliver schools smaller relative to the original plans, or would have to sacrifice some other design features to keep within the budget.

Transforming Education Delivery

At the core of the Manchester BSF programme was the goal of transforming education delivery. Calls for change in state schools are not new, neither alien to management literature (Ouchi et al. 2005). Here, innovation in school design was deemed fundamental to implement new pedagogical ideas necessary to improve the performance of state schools. These ideas included increasing flexibility in secondary curricula to account of individual needs, skills, and personalized learning; fostering stronger ties between the school and the local communities; and more and better exploitation of information and communication technologies (ICT). A BSF Manchester document explicitly stated the aim of leaving behind "scruffiness, being herded around, no time for reflection, bells, inadequate technology, poor external environment" to allow for "choosing what and how to learn, sense of individual purpose, good networker and team player, ICT confident, multi skilled." The notion

of learning transformation translated into five desired innovations to incorporate in the new school designs, summarized in Table 1.

Table 1 – Summary of Promoter-Centered Innovations and Context-of-Development Information

Innovation Case (#)	Purpose	Operationalization in Design	Exemplar of Context-of-Development Information
(1) Open layouts	Ensure facilities can accommodate flexible curricula delivery, encouraging schooling to groups of pupils of variable sizes	• Movable partition walls • long-span beams and floor plates • no floor to ceiling windows so as not to sterilize exterior walls for future uses • fewer doors between adjacent spaces	"We are saying 'why teach in 30s?' Some kids could be in groups of 45 and some in a 15, so perhaps you need a more flexible space, where some kids will be doing personalized learning, some watching a video in one corner, some working on their own." (Learning Transformation Lead Officer 2007)
(2) ICT-rich school spaces	Provide teachers with extensive ICT access for preparing and delivering lessons; Give pupils extensive ICT access for studying and group work	• Install wireless network • videoconference and broadcasting facilities • allow to spend up to 10% of project budget in ICT component	"Everything is online, the fact someone is on holiday in school time isn't a massive deal anymore because they can take all their homework and do it, teachers can mark and send back to them. You no longer need to be in school, so perhaps you no longer need a school for the overall number of kids" (project development officer 2007)
(3) Inclusive school designs	Open up school to other pupils and local communities for cultural and learning activities; Include pupils with special educational needs into mainstream schools	• Spacious entrances making bold statements; • Pleasant, large circulation spaces • Eliminate high fences and exterior window shutters; • Include areas of delight, e.g., sports centre, libraries	"It's our policy to only allow for internal shutters and to strengthen the glass. But one head teacher who wanted to make it a fortress with 3m-high fences and barbed wire actually told me 'you're standing in my way'" (Programme Manager 2007)
(4) Sustainable design	Meet call for 25% voluntary reduction in carbon emissions as part of the Manchester's aspiration to become greenest city in the UK	• Site generation of renewable energy; • Rainwater harvesting • Reduce energy and water usage	"We're cash constrained and in Manchester we do very bad in terms of education attainment, and this is tough because policies clash one with the other (…) I don't think sustainability is high on the list of head teachers. In my experience, their number one priority is how big the school is going to be" (design manager 2007)
(5) Rationalize provision of specialized classrooms	Reduce construction costs; increase flexibility in the use of space.	Replace some of the traditional science labs (with central desks serviced with sinks and gas taps) with labs only having serviced desks at the periphery	"My argument to teachers is 'you don't always teach practical science, so why do you need to be in a lab with fully-service gas and water and sinks for the whole week? Wouldn't it be better to have 2, 3 super labs which you could dip into when appropriate, and an ICT rich area where kids could work on their own and in groups,?" (Transformation Officer 2007)

The Stickiness of Promoter-Generated Information

Our findings suggest that the information about the context-of-development had some degree of stickiness. Information is sticky when its transference to a specified location in a form usable by a specified information seeker involves high costs (von Hippel 1994). This feature can be at the basis of information asymmetries between developers and end-users. Research has also shown that stickiness is a characteristic of information on user needs and context-of-use (von Hippel 1994). Interestingly, our findings suggest that stickiness can also affect the promoted-generated information:

> "It was very difficult in the first wave. We started to design in 2006, very soon after we got green light from Partnerships for School, so we weren't really able to focus that much on change, people didn't understand what was meant by transformation (…) What we got sadly, in some instances, is a number of buildings that aren't fully transformational, which are 'new old schools', except for some aspects." (2007).

To transfer information, the transformation team took head teachers to residential conferences facilitated by the national curriculum school leadership. They also took them in trips to show innovative school designs, to workshops showing how learning could be enhanced through the combination of open layouts and ICT, and brought guest speakers, namely architects with experience in school design. The Council representatives acknowledged, however, that to make users more receptive to new ideas involved a lot of time and effort. Further, they admitted that even when they had more time to work with user-teachers (as in the case of schools which design started in 2008), some teachers could remain rather dismissive towards the new ideas. We next examine the information at the heart of user-teacher's stance.

USERS' NEEDS AND CONTEXT-OF-USE INFORMATION

Which innovations would head teachers and heads of faculty like to see implemented in the new school facilities? User-centered innovation posits that users have heterogeneous needs, precluding one user from being a perfect substitute for another

with respect to innovation (Franke and von Hippel 2003). This notion was valid into new school development as, first, promoter-centered innovations were received unevenly by user-teachers according to their needs and information on context-of-use; and second, some user-teachers came forward with valuable innovative ideas which were ultimately applied across most new schools.

Teacher's information on needs and context-of-use was different from the promoter's information on the context-in-development. Instead of looking at trends for transforming educational delivery, teachers appeared primarily concerned in introducing innovations which would help them address immediate and practical problems. They anticipated facing the same operational issues in the new schools unless the delivery teams incorporated their design ideas (see summary in Table 2).

Table 2 - Summary of User-centered Innovations in School Design

Innovation Case	User-generated Information	
	Needs	Context-of-Use
Toilette Blocks	Reduce smoking and bullying in toilettes; make toilettes a more pleasant, friendly space.	Existing toilette layouts and out-of-sight locations not fit for purpose; youngsters dislike using toilettes, existing facilities induce unruly behavior
Covered Outdoor Spaces	Provide open spaces where youngsters can play in poor weather	Youngsters are difficult to control when they cannot go outside during playtime
Very large halls	Hall to sit a hundred eighty examination desks given that there are examinations going through all the year	We struggle with current size of the hall

This understanding was perhaps best exemplified by the innovative design for toilette blocks championed by teachers from one school, as an attempt to move away from traditional designs which they viewed not fit for purpose:

> "We talked at length ourselves on toilettes. In any school, if you quiz youngsters about toilets, it's a place they hate, sometimes they fear. Toilettes are ought of sight, adults are not normally there, it's an area where bullying can take place, plus smoking, truing from lessons. So we came with the idea of a huge toilette block, girls on one side, boys in another, and an office for an hygiene officer in the middle, who can see to both rooms, and also a place that can be used as a school shop where people can buy things

like pens and pencils. Cubicles doors going from floor to ceiling to give children privacy, we're doing away with urinals."

Likewise, teachers seemed concerned about how to improve pupils' behavior during play time when poor weather forced them to stay indoors. One school was so keen to have a covered outdoor space that found a way to pay for itself after the promoter insisted it could not afford to pay for the innovation out of the school budget:

> "The central space was at the heart of what we wanted for the school. We did had to fight a lot to get it in the project meetings, but we would not give up at any cost. The architects from the Dept of Education were very supportive for that, and said if this is what the school wants to do, they should be allowed to have it. That raised the barrier for us. But we had to borrow from the local authority £0.5m to pay for the roof ourselves ─ in some terms it is immoral we have to." (Deputy Head teacher 2006)

Conversely, user-teachers appeared to reject those promoter-centered innovations they perceived would not work. Some schools tended to be wary, for example, that open layouts could make it very difficult to control youngsters' behavior. They were also concerned that open layouts would generate too many acoustics problems and even health and safety issues. Likewise, some teachers were dubious about the practicality of substituting the traditional 7 to 8 science labs with 3 or 4 science labs, a specialized ICT kit, and a few classrooms showing specialized desks only at the periphery:

> "We had a meeting when we were discussing the layout of new science labs, and planners wanted to push us into open plan labs, where everything is open, you can walk from one learning area into another, less walls. Our head of science did not dismiss the idea but was quite flabbergasted. We resisted that, and we actually got what we wanted" (Deputy Head 2007)

Teachers who had consistently been achieving good results with the existing facilities, in particular, could be quite skeptical of the merits of jumping on the bandwagon for education transformations; as put by one deputy head teacher:

> "Education is changing all the time, we agree, our learning environment needs to be ready for that, but you've got to start with something that serves what you do now and can be twisted all the way along, rather than to start with something that's not going to

> serve the children that are here now ─ you're still going to need rooms where 30ish kids are going to be in ─ visions that exclude that aren't realistic. We know the sort of things that work, and some plans were a little bit impractical from our point of view."

Not all schools, however, were averse to the promoter-centered innovations. Some head teachers would behave like lead-users (von Hippel 1986), extremely enthusiastic with the possibility to be 'ahead of the game' and pioneer the implementation of new pedagogical approaches. One school, in particular, headed by a 'young and innovative head teacher willing to try something new' in the words of a Council representative, was keen to take on board the promoted-centered innovations. Its assistant head observed "Projects cover many curriculum areas and this new design [multifunctional learning spaces] allows multitask teaching, which means staff can work alongside each other and open up spaces as needed."

We next discuss the role of evidence in the process of diffusing innovation across the new school development processes.

THE ROLE OF (THE LACK OF) EVIDENCE

Research on the adoption of innovations in complex institutional settings such as health care shows the role of evidence as a factor facilitating the diffusion of innovation (Greenhalgh et al. 2005, Rye and Kimberley 2007, Ferlie et al. 2007). Here, the lack of evidence demonstrating that the promoter-centered innovations would improve schooling performance was an important factor fuelling the skepticism of some teachers. As one head teacher put it, "the plans for the new building seemed to be sort of the flavor of the month, year, decade, but we knew it wouldn't work here (…) some people involved have never worked in high schools, they lack our practical experience, knowing what it works."

A number of user-teachers, for example, acknowledged the pleasantness of the cutting-edge open space design of Hellerup school in Copenhagen, in which a wide

staircase doubles as a central assembly hall and a lecture theatre where children use the stairs as seats. However, some would be quick to point that specific school catered for pupils primarily coming from a middle class background whereas their schools served youngsters coming from very economically deprived areas. The promoter itself admitted the lack of hard data demonstrating that open layouts impacted positively performance. As a Council representative acknowledged:

> "What will learning look like? We've read and watched videos, but you're crystal ball gazing to some extent. We're trying to make the building structure flexible, but the big thing head teachers say is 'show me where it's working in the world.' Well, there aren't any great examples actually, there are some where it works well, but there's no data yet correlating it with where students are today (…) we and senior people in the education department think it's going to work." (Project Development Officer 2007)

Even assuming that evidence about the impacts of the innovations to schooling would ultimately support the Council's position, it would take many years to produce. This lack-of-evidence gave legitimacy to the reluctance of some user teachers to adopt specific innovations. Further, the Council acknowledged the benefits of involving teachers in the design. First, there were the user-centered innovations grounded in context-of-use information which would not necessarily emerge were users removed from the development process, i.e. the use-in-context and needs information could be also sticky (von Hippel 2004). The examples of innovative toilette designs and covered court yards illustrate this point. And second, there was teachers' enthusiasm with the opportunity to be part of the process to develop a new school facility, which the Council perceived could only positively impact on schooling. Yet, the Council was also cognizant that it was accountable to produce innovative designs that would support foreseeable transformation in learning. In the next section, we discuss some propositions to support the implementation of social infrastructure co-development.

DISCUSSION: INFRASTRUCTURE CO-DEVELOPMENT WITHOUT FETTERING USERS IS HARD WORK

The analysis of the empirical findings suggests that co-developing social infrastructure can be hard work in a resource-constrained environment. Reconciling promoters' and users' ideas to innovate designs with promoter's budget and schedule concerns and users' skepticism towards untested ideas can take a lot of time and effort. Indeed, extant literature shows that users and developers tend to know different things due to information asymmetries (von Hippel 2006). It also alerts that bringing the two types of information together is not easy, as needs- and solution-based information are sticky. This frustration was clearly articulated by both by a programme manager and a deputy head:

> "We [Council] are the project client, the landlord, but designs need to be signed off both by us and by head teachers before we can move into construction. We've given too much power and leeway to head teachers. Perhaps we need to be more prescriptive, and tell them 'this is what we require from you as we consult you, and this is what we're going to deliver to you." (programme manager 2007)

> "The budget for building the new school is owned by the local authority, we've never had sight of the spending figures, they're shrouded in secrecy, which is at odds with what obviously we believe because we see ourselves as the client (…) We started a few years ago building a vision, we had a residential booked for all the staff… we were very clear on the type of school that we wanted (deputy head 2007).

Co-development could be particularly difficult with schools which were doing very well from a performance perspective. These schools could try to resist innovations, and felt entitled to do so in the face of their performance:

> "We've a very strong head, and possible a really strong position because the school itself is doing exceptionally well, perhaps that gives a bit more weight to what we're saying, because we actually know what we're doing, so we should have some freedom to deliver in the way we want to (…) certain things have been absolutely no compromises on." (deputy head 2007)

Council representatives appeared to understand the position from teachers of schools which had consistently achieved good results through traditional schooling practices in a traditional facility. ‘We’ve never imposed a design solution, all designs are the result of extensive negotiations between us and the teachers’ noted a Council representative cognizant that school performance attracted a lot of interest from parents, educators, and politicians. School results in the league tables were yearly published, and school reports were available on the web. User-teachers of successful schools would therefore incur risks of failing to perform if they would allow radical changes in the delivery approach. This, in turn, meant these user-teachers would be particularly reluctant to accept radical changes in the design of the school facilities. Council representatives were, however, cognizant of their obligations towards the funding organization, and in particular, their obligation to deliver new school designs supporting the education transformation agenda over time. While the school facilities were being designed to last decades, user teachers could be about to retire, Council representatives would highlight often in the interviews.

This conundrum made Council representatives questioned the extent co-development could work without fettering users at the onset. For instance, one Council representative observed “at the end of the day it’s city council funding, and head teachers have to understand they’ll not have the final say.” Conversely, teachers would argue that “It’s not the rooms that deliver the education to people, it’s people. People need to feel good, and if they do they deliver more. We work hard, long hours to keep moral up, and I think that lends itself to really high expectations.. to expect that from staff you’ve got to be seen listening to them rather than just some tokenistic gestures.”

FINAL CONSIDERATIONS

All in all, it seems reasonable the need to balance users' reluctance in incurring high risks that untested designs do not fit the purpose with promoters' willingness to use innovative designs as an instrument to induce operational change. Both goals – user's short-term one and promoter's mid-term one – are legitimate. The crux of the infrastructure co-development problem is therefore not one of whether users should be involved. Evidence systematically suggests they should. Rather, the question seems more to be one of whether the social infrastructure co-development process can allow for unfettered users and still work in a resource constrained environment. State schools are institutions with limited funding capabilities. This means that a solution where schools would be expected to fund for some of their own innovations while the project promoter would fund for others was unrealistic.

Rather, the analysis of our findings appears to lead to four propositions for supporting the implementation of democratizing social infrastructure development:

Limiting the Space of Design Solutions

While the Ministry of Education had made available a number of standard school designs, the Council quickly deemed them inappropriate to serve as a basis for the design of large secondary schools. Overtime, the Council also realized however that co-development would progress extremely slowly if they left unrestricted the space of design solutions. In the same way that research in toolkits shows how they build upon the partition of design in needs- and solution-based subtasks, co-development of new schools also seemed to require a similar partition ex-ante of the design task:

> "We've created a design of a generic classroom which looks at the interface between ICT, furniture, and curriculum deliver. We're now designing a science room with input from the education specialists, and we'll go to the schools and say 'this is where Manchester wants you to deliver science at your school. '" (Design Manager 2007)

Use prototypes to reduce impressionistic assessments

The Council realized that not all user-teachers would have the technical capabilities to correctly interpret design drawings and specifications, and anticipate how the spaces in the drawings would exactly look like after physical execution. This could become a problem to transfer information between developers and users. As a means to facilitate the exchange of information, the Council decided to build full scale mockups of the specialized classrooms. As one design manager explained:

> "We're now building a full scale mockup of a new concept of a classroom, where we can take council people, politicians, teachers, all stakeholders to see what we propose to deliver. We brought final decoration, all the fix and furniture. It will be a once consultation."

Governance Structure

Our findings suggest that the benefits of co-development in terms of user satisfaction and user-generated innovations may ultimately outweigh the difficulties to reconcile the user and promoters' interests. That being said, in a world where the resources are scarce, the design decision-making system needs to be set up so that conflicts between users and promoters can be swiftly resolved. There were instances when the resolution of these conflicts dragged over meeting after meeting because a system was not in place so as to allow users and project managers to escalate the conflict. While the project managers could escalate the resolution of the conflict to the programme manager, the head teacher did not report to anyone above. The programme managers felt this created a 'power vacuum,' and made it difficult to ultimately push with innovative school designs if the head teacher did not want to innovative regardless if the head teacher would be retiring in the next year. Council representatives felt this process was ultimately responsible for the delivery of some 'new old schools,' in a way defeating the ethos of the BSF programme. Subsequently, a governance structure was introduced where promoter-user conflict could be escalated and swiftly resolved at a level above the programme manager-head teacher:

> "For the next batch of schools, we're trying to get the relationship with the education department a lot firmer. The head teacher will still comment on designs, but we're in the middle of writing a much clearer brief, and designers will design around the brief. We'll need the education department to sort conflict between head teacher and the brief (…) when head teachers try to push outside the brief, we want the director of the education department to push them back on line" (Programme manager 2007)

> "We cannot be totally autocratic, but by the same token we've a very rigid timeframe and cannot afford to delay the design process because we cannot cater for the needs of a committee because the key requirement is design freeze. We need to get a design that is signed off. If schools do not want to sign off that design, we've to say we're sorry , the train needs to keep moving." (design manager 2007)

5. FUTURE WORK

Understanding national innovative systems and the competitive advantage of a nation's firms matters for national policy makers (Nelson 93), as a nation gains if its consumers are some of the worlds most sophisticated and demanding. Management scholars have also argued that not enough has been done to apply management theory and what we know from research evidence to the study of major public issues (Ouchi et al. 2005). Our future research will further collect more data about the process of innovating the design across the different Manchester BSF schools. We aim to induce theory through cross-case comparisons and cycling between theory and empirical observables. Our ultimate goal is to induce a number of propositions for effectively and efficiently enacting social infrastructure co-development, or in other words, for democratizing innovation in new social infrastructure development.

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